USDA Forest Service Research Paper PNW-212
1976

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Price Impacts of Log Export Restrictions Under Alternative Assumptions

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Reference Abstract

Haynes, Richard W.
1976. Price impacts of log export restrictions under alternative assumptions. USDA For. Serv. Res. Pap. PNW-212, 25 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

The impact on softwood lumber and stumpage prices of a hypothetical ban of log exports was computed for alternative assumptions about the market for western softwood lumber. The log export ban was treated as shifting the U.S. supply of western softwood. Various assumptions were made about the direction, extent, and timing of this shift. Other critical assumptions included the values for the U.S. and Canadian supply elasticities and the U.S. demand elasticity. Price changes attributed to log export restrictions were computed for each of the various combinations of assumptions.

KEYWORDS: Supply/demand (forest products), import/export (forest products), trade policy (international).

RESEARCH SUMMARY

Research Paper PNW-212

1976

The price changes attributable to further log export restrictions depend, in part, on the values of various assumptions comprising the structure of the market for western softwood lumber. The significant assumptions are the direction, extent, and timing of the supply shift induced by log export restrictions, the degree of price responsiveness of U.S. and Canadian producers and U.S. consumers, and the relationship between stumpage and lumber prices. In recognition of the uncertainty surrounding the value for each assumption, a range of values for each assumption was used and numerous price changes were simulated.

Following a ban on log exports, western softwood lumber prices would either decrease as much as 16 percent or increase by as much as 17 percent depending on the direction assumed for the supply shift. The equivalent changes in the stumpage market would be 26 and 29 percent, respectively.

The results demonstrate that price impacts of log export restrictions are the greatest in the stumpage market. One implication is that the comparative advantage of west coast lumber in U.S. markets would be changed following log export restrictions. The extent of this change depends on how price changes in the stumpage market affect the cost of producing western softwood lumber. Another implication is the detrimental impact of lower stumpage prices on the economic feasibility of intensive management programs in the Pacific Northwest. In the long run, curtailment of these programs might result in a reduction of available supply leading to higher prices.

The advantage of the model framework is that it organizes several diverse assumptions to support various estimates of price impacts which heretofore had been a matter of conjecture. The model does not alleviate the uncertainty regarding the response of industry to policy changes. But to a large extent, industry response dictates the potential price impacts associated with changes in export policies.

BACKGROUND

Alternative log export policies have been debated on the basis of the impact of export restrictions on U.S. trade and foreign policy, value and employment created from logs in the export market compared with the domestic market, price and availability of timber in the Pacific Northwest, and U.S. forest products prices. An understanding of these issues is necessary to place in perspective the positions of various individuals and groups affected by log exports. This report addresses the issue of the effect of log export restrictions on prices. The potential impacts of trade policies on prices, however, are only part of the basis on which these policies have been considered.

The basis for concern over the price impacts of log export restrictions has centered on the price and availability of timber in the Pacific Northwest and on the price of softwood construction materials in U.S. markets. Individuals and organizations in favor of log exports have argued that higher stumpage prices due to the export market are an incentive for more intensive forest management which increases timber supply and leads to better timber utilization. Those against log exports have argued that higher stumpage prices increase competition for timber in the Pacific Northwest making producers in the region less competitive in domestic markets compared with other U.S. and Canadian producers. Those against log exports have also argued that higher stumpage prices lead to higher lumber prices and ultimately higher cost housing in the United States.

The stumpage and lumber price impacts of further restrictions of softwood log exports originating in west coast States would depend on how producers and consumers in the United States, Canada, and Japan respond to this change in trade policy. Different scenarios can be hypothesized for the type and magnitude of price impacts, depending on the assumptions made about the responses of producers and consumers in each of the countries.

Opponents of further restrictions on softwood log exports argue that restrictions would not guarantee lower stumpage and lumber prices. This argument assumes that lumber exports would not be restricted and that foreign consumers, primarily Japan, would still need construction materials of the type and quality previously manufactured from the softwood logs they formerly imported. Foreign demand for softwood lumber would therefore increase. Some of the lumber processing capacity in the United States and Canada which would have been used to produce lumber for the U.S. market would instead be used to produce lumber for Japanese consumers, especially in tight markets such as existed in 1972-73.

Several years may be necessary to increase lumber processing capacity to supply both the U.S. and foreign markets with lumber at prices which were in effect before the additional restrictions on U.S. softwood log exports. This sequence of events, after further restrictions on U.S. softwood log exports, would tend to reduce rather than increase lumber supply in U.S. markets and tend to increase rather than decrease the prices of softwood lumber in U.S. markets.

Opponents of further restrictions on softwood log exports argue that any price decreases in stumpage markets attributable to the restrictions would tend to be offset by decreased utilization of the timber resource. Less of the lower quality portion of the resource would be processed into lumber. This decrease in timber volume flowing into stumpage and log markets would tend to maintain stumpage prices.

Proponents of further restrictions on softwood log exports argue that current high log and stumpage prices in the Pacific Northwest are both symptoms of past export policies and indicators of the availability of processing capacity to use additional timber volume to be made available through additional restrictions on softwood log exports. In view of projected declines in availability of timber from private lands in the Pacific

Northwest over the next two decades and in view of uncertainties over timber flows from National Forest lands, further restrictions on exports are necessary to insure the economic viability of a major portion of the timber processing industry in the Pacific Northwest.

According to proponents of further restrictions on softwood log exports, lower stumpage prices would increase the competitive position of Pacific Northwest producers in both U.S. and foreign markets. Additional volumes of lumber from coastal British Columbia would probably be exported to Japan rather than the United States, but shipments from the rest of Canada would not be significantly affected. More lumber would be produced in the Pacific Northwest because of the additional restriction on U.S. softwood log exports and in total, U.S. softwood lumber prices would decrease.

The realization of either of these scenarios depends on the net effect of the behavior of producers and consumers after the change in trade policy. In this report, no attempt is made to evaluate either scenario in terms of the likelihood of occurrence. There is too little historical precedent to judge how the market system would respond to further restrictions on softwood log exports.

Even though a likely scenario is difficult to define for market responses to a further restriction of log exports, the price impacts associated with alternative scenarios and the sensitivity of softwood lumber and stumpage prices to various behavior patterns of producers and consumers can be demonstrated. The purpose of this report is to show for different assumptions about the structure of the softwood lumber market, the potential price impacts of a complete ban on U.S. softwood log exports. The market structures which are assumed in the following analysis do not exactly correspond with either scenario of events stated for proponents and opponents of further restrictions of softwood log exports. Despite this possible shortcoming, the analysis should prove useful in the following ways to legislators and others interested in trade policy:

1) The analysis provides an estimate of possible price impacts associated with two extreme scenarios of events.
2) The analysis demonstrates the sensitivity of price impacts to key variables in the market structure.

The sensitivity analysis approach used in this report will not resolve the debate over the price impacts of export restrictions. The analysis can be used, however, to identify the implied assumptions about market structure variables inherent in opposing views on the magnitude of price impacts. When used in this way, the analysis should aid in understanding the positions of individuals concerned about export restrictions.

THE CONCEPTUAL FRAMEWORK

The first step in assessing the potential impacts of additional log export restrictions on U.S. softwood lumber prices and Pacific Northwest stumpage prices is to define the structure of the market used in the analysis. This structure dictates how lumber and stumpage prices are determined and how a change in log export restrictions works through the market to change prices. Figure 1 illustrates the structure of the U.S. lumber market used in this analysis.

The analysis assumes that the U.S. demand for the type of softwood lumber produced in the Western United States and Canada can be represented by one demand schedule which shows how consumers change their purchases as the price of lumber changes. In figure 1, this schedule is labeled "total U.S. demand" and shows that consumers would purchase less as lumber prices increase.

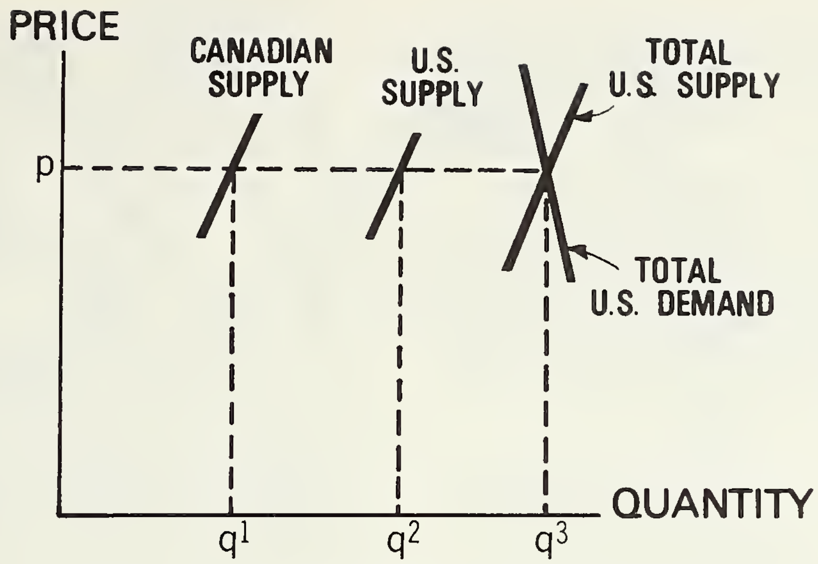

Figure 1.--Assumed model of U.S. market for western softwood lumber.

The analysis treats the U.S. supply of western softwoods as being composed of two components: lumber produced in the Western United States and lumber produced in Canada (largely in British Columbia) destined for the U.S. market. In figure 1 this is represented by U.S. and Canadian supply schedules which are summed together to form a total U.S. supply schedule for western softwoods. These supply schedules show that as the lumber price increases, both U.S. and Canadian producers manufacture more lumber for the market.

Since the quantity supplied increases as price increases and the quantity demanded decreases as price increases, the schedules of total U.S. supply and total U.S. demand intersect to determine the market price and quantity. In figure 1 the total supply and demand schedules intersect to determine the market price (p) and quantity (q^3) of western softwood lumber produced in the Western United States and Canada. The market quantity (q^3) is the sum of the western softwood lumber produced in Canada and shipped to the United States (q^1) and the western softwood lumber produced in the United States (q^2) for domestic consumption.

In the analysis used in this report, no provision is made for price induced changes in foreign demand for softwood lumber nor are any provisions made for possible limits on lumber production due to a lack of processing capacity. In addition, the analysis assumes that any additional timber volume which enters the market after implementation of export restrictions is processed into lumber. No provision is made for the possible diversion of some of this volume to the plywood industry.

These assumptions and the hypothesized structure of the U.S. market for western softwood lumber dictate how further restriction of softwood log exports might influence U.S. prices for western softwood lumber. For example assume that a log export restriction induces greater U.S. production of western softwood lumber. In terms of this analysis, the chain of events following an increase in production is summarized in figure 2. The U.S. supply curve shifts outward (to the right). The Canadian supply schedule is not shifted by the change in U.S. supply nor is the total U.S. demand for western softwood lumber. Because total U.S. supply is defined as the sum of Canadian and U.S. production, total U.S.

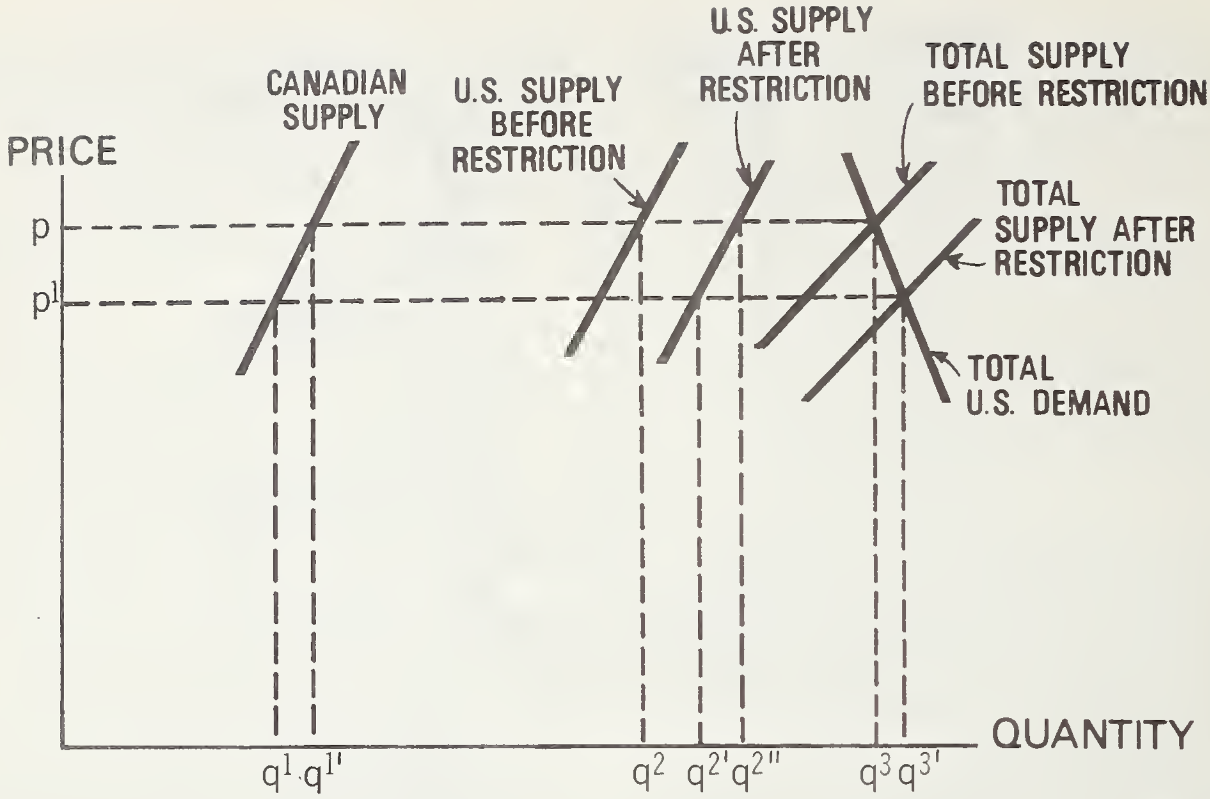

Figure 2.--The assumed effect of an increase in the U.S. supply of western softwoods.

supply in figure 2 is shifted to the right by the additional restrictions on softwood log exports. The shift in the total U.S. supply schedule shifts the intersection with total U.S. demand downward to a lower price, P^1. In the example shown in figure 2, Canadian producers are willing to produce less at the lower price so Canadian imports decline from q^1 to $q^{1'}$. If U.S. producers did not respond to the lower price by reducing output, U.S. supply of western softwood lumber would have increased from q^2 to $q^{2''}$. Because of the decline in production due to lower prices, U.S. supply only increases from q^2 to $q^{2'}$. Consumers respond to lower prices by increasing their purchases. In total, U.S. consumption would increase from q^3 to $q^{3'}$ following the increase in supply.

The changes in price from P to P^1 depend on two factors: the direction, extent, and timing of the shift in the U.S. supply schedule and the responsiveness of U.S. consumers, U.S. producers, and Canadian producers to changes in prices. The first factor is surrounded by uncertainty as there is little consensus among interested groups on either the direction or extent to which the U.S. supply would shift following a restriction of log exports. Figure 2 illustrates only the case where the U.S. supply curve shifts out by some amount. In the case where U.S. supply is decreased (because of increased foreign demand), the price change would be in the opposite direction. That is, prices would increase following a restriction of log exports.

In figure 2, both consumers and producers are assumed to be price responsive, implying that amounts demanded and supplied change as price changes. The responsiveness of either supply or demand to changes in price

is measured by the elasticity of the supply or demand schedule. The elasticity (ε) of either schedule is calculated as the percentage change in quantity (q) divided by the percentage change in price (p):

$$\varepsilon = \Delta q/q/\Delta p/p. \qquad (1)$$

If a percentage change in price is accompanied by a larger percentage change in quantity, the supply or demand schedule is termed elastic. If a percentage change in price is accompanied by a smaller percentage change in quantity, supply or demand is termed inelastic.

Although supply and demand elasticities help determine the price impacts of shifts in supply depicted in figure 2, there is little agreement among industry analysts on the appropriate values for either supply or demand elasticities.

THE APPROACH USED IN THE ANALYSIS

The general approach used in this analysis was to first estimate price changes associated with two extreme scenarios of events. These price changes establish a range which would act as boundaries to other estimates of price changes. The second part of the approach was to test the sensitivity of price changes to changes in: (1) the elasticity estimates associated with the supply and demand schedules depicted in figure 1 and (2) the volume of logs implied by the shift in lumber supply illustrated in figure 2.

This analysis is based on expressing the conceptual framework illustrated in figures 1 and 2 analytically as a system of equations. This analytical model is based, for each year, on developing supply and demand equations and solving them simultaneously for lumber price given the actual quantity plus additional quantity derived from logs formerly exported. Stumpage prices are then derived from lumber prices in such a way that a change in lumber prices is also reflected in a change in stumpage prices. The specification and solution of the analytical model is discussed in appendix A.

In general, the stumpage market is considered to be less elastic than the lumber market because the demand for stumpage is derived from the demand for lumber. This implies that stumpage prices change at a relatively faster rate than do lumber prices.

EXTREME SCENARIOS

The extreme scenarios deal with the direction of the shift in the U.S. supply schedule induced by a restriction of log exports. The first alternative deals with a situation where mills may be operating short of capacity and a log export restriction increases the amount of domestic production. In this case the U.S. supply schedule is assumed to shift outward by the amount of formerly exported timber which is now being processed for domestic use. The total supply curve shifts outward and is accompanied by a decline in prices. The second alternative deals with a situation where mills may be operating at capacity and a log export restriction increases the foreign demand for western softwood lumber. In this case, the quantity of softwood lumber available to U.S. consumers declines resulting in the total supply curve shifting inward (to the left). This movement is accompanied by an increase in prices.

VALUES FOR THE MAJOR ASSUMPTIONS

To implement an analytical model based on the economic framework illustrated in figure 1 requires a number of assumptions specifying values for the supply and demand elasticities and the direction, extent, and timing in the shift of the U.S. supply schedule. This study considers a range of values for each assumption since little consensus exists for the values of any particular assumption. This range is

established by two extreme values and one value from near the midpoint of the range. Three values provide enough information to determine the shape (linear or nonlinear) of the relationship between price changes and levels for each assumption.

The time frame of the analysis is 1973 through 1975. Using prices and quantities for this period implies that the computed price changes represent a hypothetical ban on log exports effective January 1, 1973. This approach avoids the need for projections of prices and quantities which themselves may be suspect. These results can be generalized to other time periods by extrapolating the price impacts for the 1973-75 period in a linear fashion. The data are discussed in appendix B.

Induced Shifts in Supply

The lumber and stumpage price impacts depend, in part, on how much the total supply curve shifts following a restriction of log exports in 1973. In the approach used in this analysis, different assumptions were made about the extent and timing of shifts in the supply schedule of western softwood lumber. Three assumptions were adopted for the extent of supply shifts. The first assumption was that the U.S. supply schedule was not affected by a change in log export policy. The second assumption specifies that the U.S. supply schedule shifts by the lumber equivalent of 50 percent of the logs exported in 1973. The last assumption specifies that the U.S. supply schedule shifts by the lumber equivalent of 100 percent of the logs exported in 1973. In addition, three assumptions were made defining the timing of the supply shifts. These assumptions, involving the extent and timing of supply shifts, lead to the seven assumptions shown in table 1. The assumed maximum change in volume was 3.4 billion board feet (lumber scale). This is equivalent to the volume of logs exported from Washington, Oregon, and California in 1973.

The assumptions in table 1 show how much the supply schedule shifts in

Table 1--*Assumptions about the extent and timing of the total supply shifts following a restriction of log exports in 1973*

(Billion board feet, lumber scale)

Year	Assumptions						
	I[1]	II[2]	III[2]	IV[2]	V[3]	VI[3]	VII[3]
1973	0	1.70	0.68	1.02	3.40	1.36	2.04
1974	0	0	.51	.51	0	1.02	1.02
1975	0	0	.51	.17	0	1.02	.34

[1]Assumes that the U.S. supply curve was not affected by a change in log export policy.
[2]Assumes that the U.S. supply curve shifts (over a 3-year period) by the lumber equivalent of 50 percent of the logs exported in 1973.
[3]Assumes that the U.S. supply curve shifts (over a 3-year period) by the lumber equivalent of 100 percent of the logs exported in 1973.

each of the 3 years under consideration. For example, the sixth assumption implies that the U.S. supply curve shifts by 1.36 billion board feet in 1973 and 1.02 billion board feet in 1974 and 1975. The directions of the shifts depend on the scenario of economic events adopted.

The seven assumptions listed in table 1 apply to both inward and outward shifts in the U.S. supply schedule. For example, the fifth assumption states that the U.S. supply schedule either shifts outward or inward by 3.4 billion board feet. If the schedule shifts outward then the U.S. supply has expanded assuming foreign consumers of U.S. softwood logs have not increased their consumption of U.S. lumber and that domestic processing capacity is available. An inward shift implies that foreign consumers have increased their consumption of U.S. lumber to offset the volume of logs they formerly imported. In tight markets this would lead, still considering assumption V, to a 3.4 billion-board-foot reduction in supply. In more normal times or considering less than a total offset by foreign consumers, this scenario of events might lead to a smaller shift in the U.S. supply schedule.

Demand and Supply Elasticities

The price changes associated with a shift in the U.S. supply curve attributable to a restriction of log exports depend not only on the shift but also on the extent to which there is movement along both the supply and demand curves. This movement is determined by the elasticities assumed for the supply and demand schedules.

Estimates of the elasticity of the U.S. demand for softwood lumber have ranged from roughly -0.2 to -1.6 (Adams 1974, and Adams and Blackwell 1974). In this analysis, the price impacts of the shifts in the U.S. supply of western softwood lumber were calculated for three estimates of the elasticity associated with the U.S. demand schedule for western softwood lumber: -0.2, -0.8, and -1.6. These elasticities reflect the tastes and preferences of lumber consumers which are slow to change. Hence, these estimates are applicable to each of the 3 years included in the model.

Estimates of the elasticity of the U.S. supply schedule for western softwoods have ranged from roughly 0.6 to 1.6 (Adams[1] and Mills and Manthy 1974). In this analysis, the price impacts of shifts in U.S. supply of western softwood lumber were calculated assuming supply elasticities of 0.6, 1.0, and 1.6. The supply elasticity estimates remain the same throughout the 3-year period because the collective behavior of producers is fairly stable for such a short period. In longer periods, however, supply elasticities are usually seen as being more volatile than demand elasticities because they are based on the behavior of a smaller number of individuals.

No information is available on the elasticity of the Canadian supply schedule in the U.S. market for western softwoods. Manning (1975) found that the Canadian domestic market is directly tied to the U.S. market, and both lumber supply and demand schedules are inelastic. In this analysis, the Canadian supply elasticity was arbitrarily assumed to be less than, equal to, or greater than the estimate for the U.S. supply schedule. These assumptions are shown in table 2.

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[1] Adams, Darius M. 1976. Further simulations of the price effects of shifts in National Forest harvest schedules. 10 p., plus appendixes. Unpublished report prepared for USDA For. Serv., Pac. Northwest For. & Range Exp. Stn., Portland, Oreg.

Table 2--*Assumptions about Canadian supply elasticities compared to U.S. supply elasticities*

Supply elasticity	Estimates		
United States	0.6	1.0	1.6
Canadian			
less than U.S.	.4	.8	1.4
equal to U.S.	.6	1.0	1.6
greater than U.S.	.8	1.2	1.8

PRICE IMPACTS OF A RESTRICTION ON LOG EXPORTS

Price changes attributable to a change in supply induced by a restriction of log exports are shown in tabular form in appendix C. A total of 756 price changes were computed for the various combinations of assumptions. The procedure was to first specify the elasticities of the two regional supply functions and the national demand function. Given these elasticities, the next step was to quantify the demand and supply schedules using the technique discussed in appendix A. The next step involves selecting from table 1 an assumption about the extent and timing of the supply shift and making an assumption about the direction of the shift. With this information, the change in lumber prices and the corresponding change in stumpage prices were calculated.

In appendix C, the results are compiled into nine tables; and the selection of any one table depends on the two related assumptions about U.S. and Canadian supply elasticities. A guide to the tables is presented in appendix C.

As an example, suppose the following specific assumption had been made: U.S. and Canadian supply elasticities are are 1.0 and 0.8 respectively. This would lead to the selection of table 6 in appendix C. Further, assume that the supply curve shifts outward by 1.70 billion board feet following a restriction of log exports. The price impacts (in percentage terms) associated with these events are shown in the following tabulation.

Demand elasticity estimate of a restriction on log exports	Assumption about the supply shift[2]		
	II	III	IV
Lumber			
	Percent impact on price		
-0.20	4.5	5.3	5.0
-0.80	3.0	3.5	3.3
-1.60	2.0	2.4	2.3
Stumpage			
	Percent impact on price		
-.115	8.5	8.9	8.6
-.461	5.6	5.8	5.6
-.922	3.9	4.0	3.9

[2]See table 1.

Given the tabular information, the remaining assumptions deal with the value for the demand elasticity and the timing of the shifts in the U.S. supply schedule. Continuing the example, suppose that the demand elasticity is -0.8 and that the supply shift occurs in 1973 (assumption II, table 1). Therefore, the price impact of a restriction on log exports is 3.0 percent in the lumber market and 5.6 percent in the stumpage market. That is, lumber prices are decreased by $6.08 per thousand board feet (from $204.80 per thousand to $198.72 per thousand).

In the analysis, price changes measured in dollars are the same in both lumber and stumpage markets. In the example, stumpage prices also decrease by $6.08 per thousand (from $107.81 per thousand to $101.73 per thousand). The percent changes, however, differ as shown in the tabulation. Parallel changes in each market result from the approach used to link the markets and are explained in appendix A.

THE RANGE OF PRICE IMPACTS

The range of prices and price impacts found in this analysis is as follows:

	Price (supply curve shifts outward)		Average 1973-75 price	Price (supply curve shifts inward)	
	(Dollars)	(Percent)	(Dollars)	(Dollars)	(Percent)
Lumber	174.12	-15.8	206.71	242.71	17.4
Stumpage	90.27	-26.5	122.86	158.92	29.3

The assumptions underlying these price changes were that the U.S. demand, U.S. supply, and Canadian supply elasticities were -0.2, 0.6, and 0.4, respectively, and that the U.S. supply curve was assumed to shift in each of the 3 years by the amount shown for assumption VI in table 1.

The range establishes the limits but provides little information on which to base expectations regarding possible price changes associated with less extreme assumption combinations. This information is best given by the distribution of price changes over various dollar intervals. In this analysis, there are 378 possible price changes associated with the lumber market. The distribution of these price changes is shown by the following:

Price interval	Percent of price changes
(Dollars)	
0- 5	26.5
5-10	35.2
10-15	21.7
15-25	12.4
25+	4.2

Based on these values, most of the price changes (61.7 percent) associated with the various combinations of assumptions are $10 or less and in only 16.6 percent of the assumption combinations would the price change be greater than $15 per thousand board feet.

SENSITIVITY OF PRICE CHANGES TO EACH ASSUMPTION

The analysis presented in this paper is an example of the use of a partial-equilibrium analysis to depict an equilibrium situation. One variable--the U.S. supply schedule--is changed; other factors are assumed constant and the new equilibrium position is observed. This method is useful in illustrating the influence of a supply shift on lumber and stumpage prices, but it may be somewhat misleading when applied to a "real world" situation where other factors may change.

The extent to which the supply schedule shifts depends on the volume of logs formerly exported being processed for the domestic market. Given the shift in the U.S. supply schedule, the magnitude of the price impact is determined by the estimates of the elasticities of the U.S. demand and the U.S. and Canadian supply schedules. The ranges of the elasticity estimates used in this analysis bracket published estimates. This raises the issue of the sensitivity of the price impacts associated with a shift in supply. If the price impacts of further softwood log export restrictions are sensitive to these elasticity assumptions, then this adds further uncertainty to the ability of a model to assess the impacts of a change in trade policy.

In order to assess the sensitivity of lumber and correspondingly stumpage price changes to the value of the elasticity of either lumber supply or demand requires that all other components of the market structure be specified. The data used in the remainder of this section of the report are drawn from the tables in appendix C and show the price changes associated with an inward shift in the supply schedule under various assumptions about supply and demand elasticities.

One major concern is the sensitivity of price impacts to various estimates of the U.S. and Canadian supply elasticities. In general, price changes vary inversely with the magnitude of elasticity estimates. That is, the more inelastic an estimate is, the greater will be the change in price following a change in quantity. Figure 3 illustrates this relationship assuming the demand elasticity is equal to -0.2 and that, in 1973, 100 percent of the restricted logs are domestically processed (assumption V, table 1). The figure shows that price impacts become

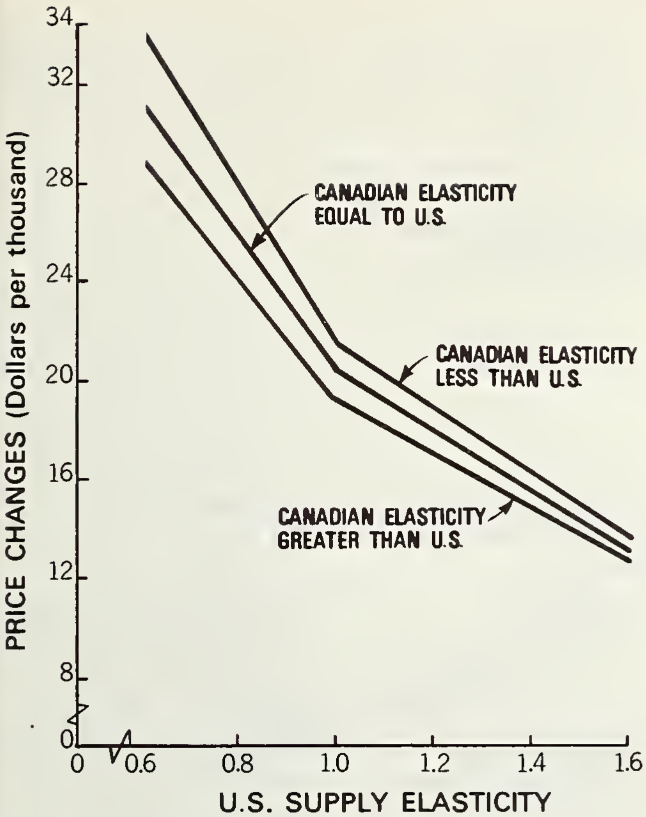

Figure 3.--Sensitivity of lumber price changes to U.S. and Canadian supply elasticity estimates.

more sensitive as the estimates of elasticity become more inelastic. Hence, any small error in the elasticity estimate may have a serious impact on the estimate of price change. For example, the difference in price changes between elasticity estimates of 0.6 and 0.8 range from roughly \$5 to \$6 depending on the Canadian supply elasticity. At the other extreme portion of the curve, the difference in price impacts--associated with U.S. supply elasticity estimates of 1.4 and 1.6--range from roughly \$1 to \$2.

Figure 3 also illustrates the influence of various estimates of the Canadian supply elasticities on price changes resulting from an inward shift in the U.S. supply schedule. The difference in price changes varies from roughly \$5 assuming a supply elasticity of 0.6 to \$1 assuming a supply elasticity of 1.6. The likelihood of a serious error in the estimated price change is increased as the supply elasticity becomes more inelastic.

The sensitivity of price changes following a supply shift induced by log export restrictions to different estimates of the demand elasticity are shown in figure 4. The price changes in figure 4 reflect U.S. and Canadian supply elasticities of 0.6 and 0.4. In figure 4, the relationship is downward sloping indicating that price changes are inversely related to demand elasticity estimates. For example the price change associated with a demand elasticity estimate of -0.2 is three times as great as that associated with an estimate of -1.6. Figure 4 also shows the effect of assuming different time paths for processing the volume of logs affected by the restriction. There is little difference between the estimates because the price of softwood lumber has remained relatively unchanged during the period 1973-75.

In figure 4 the U.S. supply schedule was assumed to shift inward. If it were assumed to shift outward, the relationship shown in figure 4 would be slightly lower but still very similar to what is shown.

The relationship between price changes and the assumed changes in the amount of restricted logs processed is linear. That is, the magnitude of price changes varies directly with the quantity processed. Given the assumptions underlying figure 4, a doubling of the quantity processed leads to price changes which are roughly doubled.

SUMMARY

This study has shown, for alternative softwood lumber market structures, the potential impacts on western softwood lumber and stumpage prices assuming softwood log exports had been banned at the beginning of 1973. The components of each market structure consisted of a supply schedule for western softwood lumber (produced in the United States), a supply schedule for softwood lumber imports from Canada, and a U.S. demand schedule for western softwood

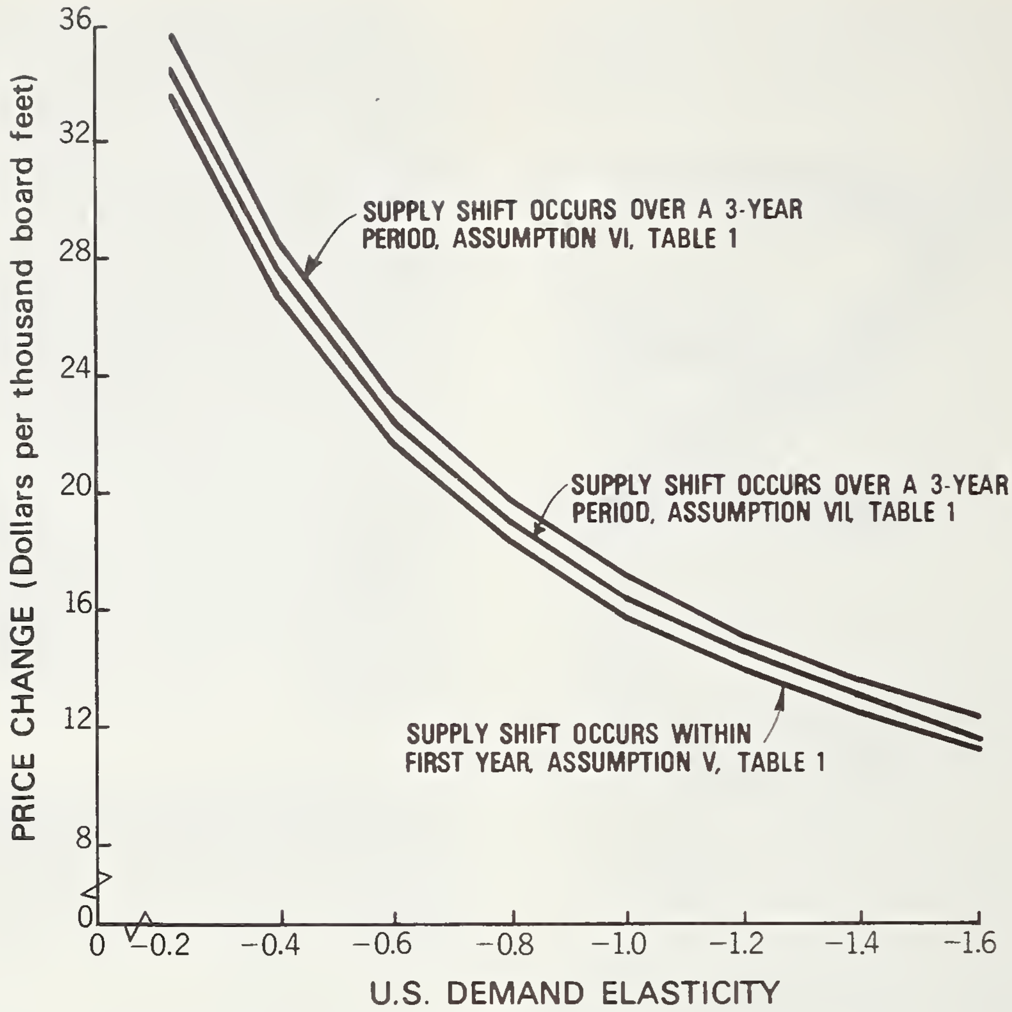

Figure 4.--Sensitivity of lumber price impacts to U.S. demand elasticity estimates.

lumber. Stumpage price changes were included by linking them to lumber price changes. The procedure used in the study was to assume that the ban on softwood log exports shifted the U.S. supply schedule for western softwoods in either direction and by varying amounts over the period 1973-75. The resulting lumber and stumpage price impacts were shown to depend on the elasticities assumed for the supply and demand schedules hypothesized in the market structure.

The study was not designed to predict lumber and stumpage price changes associated with a ban on log exports. The market structures assumed in the study did not include provisions for either the possible trade-offs between foreign and domestic consumption or processing capacity constraints on U.S. lumber and stumpage prices. The actual effects on prices in the event of a ban on softwood log exports would depend heavily on current market conditions and producer and consumer reactions at the time of the change in trade policy. Reasonable rationales could be developed for either price increases or price decreases in the event of further restrictions of softwood log exports.

The study does provide an estimate of the extreme changes in western softwood lumber and stumpage prices which could have been associated with

a ban on softwood log exports at the beginning of 1973. Assuming the most inelastic supply and demand schedule, the analysis shows that the lumber price change between extremes would range from a decrease of 16 percent to an increase of 17 percent. The analysis shows stumpage price changes ranging from a decrease of 26 percent to an increase of 29 percent. Changes in foreign demand, possible capacity limits, and differences in timber species between logs processed domestically and exported would probably tend to offset some of these price changes.

The maximum percentage change in lumber and stumpage prices calculated in this study for 1973-75 was based on data for a period when markets were both tight (1973) and depressed (1975). Although the maximum percentage change for any future modification in trade policy would tend to vary according to market conditions, the extremes of the market structure hypothesized in this study make the estimate for 1973-75 a reasonable indicator for future changes in policy.

The study found western softwood lumber and stumpage prices to be sensitive to the elasticities used for the supply and demand schedules in the assumed market structure. The study also demonstrated that stumpage price changes are greater (in percent terms) than the corresponding lumber price changes. This is consistent with the differences in demand elasticities between the lumber and stumpage markets. For stumpage in Washington and Oregon, the percentage change in stumpage prices was on the order of 1.6 times the percentage change in lumber prices. Stumpage prices would probably change by more than this in the State of Washington where the log export industry is concentrated.

The study does not resolve the debate over what might happen to lumber and stumpage prices if softwood log exports were to be banned. The study does place both an upper and lower limit on the possible change in prices which might occur if trade policy were to change. The study further defines the sensitivity of price changes to the values for the elasticities of supply and demand schedules. This finding adds to rather than clarifies the uncertainty surrounding the trade-offs from different trade policies. The demonstrated sensitivity of price changes to these technical parameters of of forest product markets demonstrates their importance in any analysis of the impacts of a change in trade policy. Using a range of elasticities which bracketed published estimates of these market parameters, lumber price was found to vary by as much as 11 percent according to which elasticity was assumed for the U.S. demand schedule and 10 percent for the assumptions about the supply schedules. There is little agreement among industry analysts on the appropriate values to be assigned to the supply and demand schedules used in this study.

As expected, the effects of further restrictions of softwood log exports on prices were especially sensitive to how much this change in trade policy would shift the U.S. softwood lumber supply schedule. This study shows the effects on prices for a number of supply shifts, but does not provide any rationale for predicting the magnitude of any shift which might occur in the event of a change in trade policy.

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APPENDIX A

SPECIFICATION AND SOLUTION OF THE ANALYTICAL MODEL

The specification of the analytical model involves three types of relationships: (1) the specification and solution of the supply and demand functions, (2) between lumber and stumpage prices, and (3) between lumber and stumpage elasticities. The functional expressions used in this appendix are expressed in logarithmic form in an attempt to facilitate interpretation.[1]

Specification and Solution of the Supply and Demand Functions

The supply and demand functions employed in the analytical model were not estimated from time series data but rather solved for some year given the market price, quantity, and an estimate of elasticity. The development of these relationships began with the assumption that the form of the relationship between price and quantity was hyperbolic which has the property of constant elasticity. This functional form could be expressed as

$$q = \alpha\, p^{\varepsilon} \qquad (2)$$

$$\text{or } \ln q = \ln\alpha + \varepsilon \ln p;$$

where α is a constant and the sign associated with ε is positive for supply functions and negative for demand functions. Equation 2 can be rewritten so that quantity is expressed in terms of known variables. For the national demand function, equation 2 can be rewritten as

$$\ln q = \ln\hat{q} + \varepsilon\,(\ln\hat{p} - \ln p); \qquad (3)$$

where $\hat{q}$ and $\hat{p}$ are reported quantities and prices for a given year. For the Canadian and U.S. supply functions, equation 2 can be rewritten as

$$\ln q = \ln\hat{q} + \varepsilon\,(\ln p - \ln\hat{p}). \qquad (4)$$

In both equations the sign of ε is positive.

The determination of price and quantity requires the simultaneous solution of the national demand function (equation 3) and the Canadian and U.S. supply functions (in the form of equation 4). In this case, the system of three equations was solved by an iterative procedure in which, by slightly changing price, each iteration converged on the correct solution.

The use of logarithms introduces a slightly different economic interpretation of the demand curve. In this case, the curve is interpreted as exhibiting constant rather than variable elasticity as is the case with linear demand curves. With linear curves, a percentage change in price is accompanied by a progressively smaller percentage change in quantity. When log-linear curves are adopted, a given percentage change in price is accompanied by corresponding[2] percentage change in quantity irrespective of the magnitude of quantity. In this report, this limitation is not a major concern because the computed price changes are not located in the extreme portions of the curves.

[1]Often demand and supply curves are expressed in logarithms (which measure percentage changes) so that the slope and the elasticity of the function are equivalent.

[2]If the elasticity was assumed to be 1 then the percentage changes would be exactly the same.

Linkage Between Lumber and Stumpage Markets

This study has considered the effect of a change in stumpage supply only as it is reflected in changes in the lumber market. This creates the problem of how to translate a change in lumber price into the corresponding change in stumpage price. In the analytical framework, the linkage between stumpage and lumber markets was described by two relationships. These relationships are based on derived demand concepts and assume the elasticity of substitution between stumpage and other factors of production to be zero. It assumes that the price difference between the two markets is a constant and can be expressed as

$$p^S = p^L - m; \tag{5}$$

where p^S is the price of stumpage,

p^L is the price of lumber, and

m is a constant equal to the difference between p^S and p^L.

In this case, the lumber and stumpage demand curves would be seen as being parallel to each other. Given the assumptions made for the previous equation, an expression can be developed relating the elasticity in the stumpage market to the elasticity in the lumber market. The proof of this relationship is presented in a study by George and King (1971). This relationship is expressed as

$$e^S = e^L \; p^S/p^L; \tag{6}$$

where the superscripts refer to the stumpage and lumber markets.

The wholesale lumber price will always be greater than the stumpage price. Thus, the price ratio p^S/p^L will always be less than one implying the e^S will always be less elastic than e^L.

APPENDIX B

DATA USED IN THE ANALYSIS

Data covering a 3-year period are necessary to support the assumption that a 3-year period may be required for logs to enter the domestic market. The most recent period (1973 through 1975) was chosen because it reflects price trends which are likely to continue in the near future. Admittedly, this is not a typical period because of the swings which took place in forest products markets, but the resulting price impacts represent an upper limit to what might be expected. These results can be generalized to other time periods by extrapolating the price impacts for the 1973-75 period in a linear fashion.

In the development of the analytical model, western softwood data were used because the majority of the log exports are from the west coast and any additional lumber output derived from the logs would enter the market as western softwood lumber. In addition, the majority of Canadian imports are western softwoods and as such are generally substitutable for western softwood lumber produced in the United States. Western softwood lumber production was used for the quantity data while Douglas-fir lumber prices were used as a proxy for western softwood lumber prices. The supply equation for Canadian exports, to the United States, also used Douglas-fir lumber prices. These data are shown in table 3.

Table 3--*Price and quantity data used in the study*

Required data	Unit column	1973	1974	1975
Douglas-fir lumber price[1]	Dollars per thousand	204.8	208.81	207.14
Western softwood lumber production[2]	Billion board feet	22.6	19.7	18.7
U.S. lumber imports from Canada[2]	Billion board feet	8.84	6.73	5.68
Stumpage price in western Washington and Oregon[3]	Dollars per thousand	107.81	146.41	119.38

[1]Price per thousand board feet, converted to dollars from the wholesale price index.

[2]Billion board feet, from "The Demand and Price Situation for Forest Products," by Robert B. Phelps, USDA For. Serv. Misc. Publ. 1315, p. 85, 1975.

[3]Price per thousand board feet, average of Forest Service bids in western Washington and Oregon.

APPENDIX C

PRICE CHANGES INDUCED BY A LOG EXPORT RESTRICTION

The lumber and stumpage price changes induced by log export restrictions are shown in this appendix. The table numbers associated with each of the possible combinations of U.S. and Canadian supply elasticities are shown in table 4. In general, price changes are expressed as the percentage change per thousand board feet (MBF) and are shown in tables 5-13. To convert percentage changes to a dollar basis, multiply the percentage change by the prices given in the notes for each table. For example, if the percentage change was 6.77 percent for the second assumption (II) about the supply curve shifting outward, then the dollar price change would be $13.86 per MBF lumber scale.

Table 4--*Guide to tables 5-13*

Table number	U.S. supply elasticity	Canadian supply elasticity
5	0.6	0.4
6	1.0	0.8
7	1.6	1.4
8	0.6	0.6
9	1.0	1.0
10	1.6	1.6
11	0.6	0.8
12	1.0	1.2
13	1.6	1.8

TABLE 5 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2]											
		SUPPLY CURVE SHIFTS OUTWARD[3]						SUPPLY CURVE SHIFTS INWARD[3]					
		II	III	IV	V	VI	VII	II	III	IV	V	VI	VII
LUMBER													
-.2000	0.00	6.81	8.07	7.63	12.80	15.77	14.82	7.82	8.48	8.13	16.78	17.44	16.85
-.8000	0.00	3.84	4.49	4.23	7.34	8.84	8.34	4.23	4.69	4.48	8.94	9.53	9.15
-1.6000	0.00	2.43	2.83	2.68	4.66	5.59	5.27	2.63	2.95	2.81	5.51	5.95	5.70
STUMPAGE													
-.1153	0.00	12.95	13.58	13.06	24.32	26.53	25.36	14.85	14.26	13.91	31.87	29.35	28.82
-.4611	0.00	7.29	7.55	7.23	13.94	14.88	14.26	8.03	7.90	7.66	16.98	16.03	15.65
-.9221	0.00	4.61	4.77	4.59	8.86	9.40	9.02	5.00	4.96	4.80	10.47	10.02	9.75

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 0.6 AND 0.4, RESPECTIVELY.
[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION		
	II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974	1975
	(BILLION BOARD FEET)		
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE 6 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2]											
		SUPPLY CURVE SHIFTS OUTWARD[3]						SUPPLY CURVE SHIFTS INWARD[3]					
		II	III	IV	V	VI	VII	II	III	IV	V	VI	VII
LUMBER													
-.2000	0.00	4.48	5.28	5.03	8.55	10.35	9.74	4.98	5.49	5.24	10.59	11.25	10.78
-.8000	0.00	2.97	3.47	3.27	5.69	6.85	6.47	3.24	3.61	3.44	6.81	7.34	7.04
-1.6000	0.00	2.05	2.38	2.26	3.94	4.71	4.45	2.21	2.47	2.34	4.62	5.02	4.80
STUMPAGE													
-.1153	0.00	8.51	8.89	8.55	16.24	17.41	16.66	9.47	9.23	8.96	20.11	18.93	18.45
-.4611	0.00	5.64	5.84	5.60	10.82	11.52	11.07	6.16	6.07	5.89	12.95	12.34	12.04
-.9221	0.00	3.89	4.01	3.87	7.49	7.92	7.62	4.20	4.16	4.01	8.77	8.45	8.20

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 1.0 AND 0.8, RESPECTIVELY.

[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION		
	II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

	1973	1974	1975
	(BILLION BOARD FEET)		
ASSUMPTION			
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE 7 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2] — SUPPLY CURVE SHIFTS OUTWARD[3] II	III	IV	V	VI	VII	SUPPLY CURVE SHIFTS INWARD[3] II	III	IV	V	VI	VII
							LUMBER						
-.2000	0.00	2.97	3.47	3.27	5.69	6.85	6.47	3.24	3.61	3.44	6.81	7.34	7.04
-.8000	0.00	2.22	2.60	2.45	4.27	5.10	4.53	2.40	2.68	2.55	5.02	5.43	5.19
-1.6000	0.00	1.66	1.94	1.83	3.21	3.82	3.61	1.79	2.03	1.93	3.71	4.05	3.88
							STUMPAGE						
-.1153	0.00	5.64	5.84	5.60	10.82	11.52	11.67	6.16	6.07	5.89	12.95	12.34	12.04
-.4611	0.00	4.22	4.37	4.23	9.12	8.58	8.20	4.57	4.50	4.36	9.53	9.14	8.89
-.9221	0.00	3.15	3.26	3.13	6.10	6.43	6.18	3.39	3.36	3.25	7.05	6.81	6.63

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 1.6 AND 1.4, RESPECTIVELY.
[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974	1975
	(BILLION BOARD FEET)		
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE 8 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2] — SUPPLY CURVE SHIFTS OUTWARD[3] II	III	IV	V	VI	VII	SUPPLY CURVE SHIFTS INWARD[3] II	III	IV	V	VI	VII
LUMBER													
-.2000	0.00	6.36	7.57	7.15	12.04	14.77	13.89	7.18	7.94	7.59	15.36	16.22	15.53
-.8000	0.00	3.69	4.33	4.09	7.07	8.52	8.06	4.05	4.49	4.27	8.53	9.17	8.77
-1.6000	0.00	2.37	2.76	2.63	4.56	5.45	5.16	2.56	2.83	2.73	5.34	5.82	5.54
STUMPAGE													
-.1153	0.00	12.68	12.74	12.24	22.88	24.85	23.77	13.64	13.35	12.98	29.19	27.29	26.57
-.4611	0.00	7.01	7.29	7.00	13.42	14.34	13.79	7.68	7.55	7.31	16.20	15.43	15.00
-.9221	0.00	4.50	4.64	4.49	8.66	9.18	8.03	4.87	4.85	4.67	10.14	9.79	9.48

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 0.6 AND 0.6, RESPECTIVELY.

[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974	1975
	(BILLION BOARD FEET)		
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE 9 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2] — SUPPLY CURVE SHIFTS OUTWARD[3]						SUPPLY CURVE SHIFTS INWARD[3]					
		II	III	IV	V	VI	VII	II	III	IV	V	VI	VII
LUMBER													
-.2000	0.00	4.30	5.06	4.80	8.21	9.92	9.33	4.76	5.24	5.02	10.01	10.71	10.28
-.8000	0.00	2.88	3.37	3.20	5.54	6.66	6.29	3.13	3.50	3.34	6.56	7.12	6.81
-1.6000	0.00	2.00	2.35	2.23	3.87	4.63	4.38	2.16	2.42	2.31	4.50	4.90	4.68
STUMPAGE													
-.1153	0.00	6.16	8.51	8.20	15.59	16.68	15.96	9.03	8.81	8.59	19.02	18.02	17.60
-.4611	0.00	5.48	5.67	5.48	10.53	11.20	10.76	5.95	5.89	5.72	12.47	11.98	11.66
-.9221	0.00	3.80	3.95	3.81	7.36	7.78	7.49	4.11	4.06	3.95	8.55	8.24	8.01

1. [1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 1.0 AND 1.0, RESPECTIVELY.
[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974	1975
	(BILLION BOARD FEET)		
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE 10 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2] — SUPPLY CURVE SHIFTS OUTWARD[3]						SUPPLY CURVE SHIFTS INWARD[3]					
		II	III	IV	V	VI	VII	II	III	IV	V	VI	VII
LUMBER													
-.2000	0.00	2.88	3.37	3.20	5.54	6.66	6.29	3.13	3.50	3.34	6.56	7.12	6.81
-.8000	0.00	2.17	2.54	2.40	4.18	5.02	4.74	2.35	2.61	2.49	4.89	5.32	5.09
-1.6000	0.00	1.63	1.90	1.81	3.16	3.76	3.56	1.75	1.96	1.86	3.64	3.98	3.80
STUMPAGE													
-.1153	0.00	5.48	5.67	5.48	10.53	11.20	10.76	5.95	5.89	5.72	12.47	11.98	11.66
-.4611	0.00	4.13	4.27	4.10	7.95	8.45	8.11	4.46	4.39	4.26	9.29	8.95	8.71
-.9221	0.00	3.10	3.20	3.09	6.00	6.33	6.09	3.33	3.30	3.19	6.92	6.70	6.49

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 1.6 AND 1.6, RESPECTIVELY.
[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974	1975
	(BILLION BOARD FEET)		
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE II PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2] — SUPPLY CURVE SHIFTS OUTWARD[3] II	III	IV	V	VI	VII	SUPPLY CURVE SHIFTS INWARD[3] II	III	IV	V	VI	VII
							LUMBER						
-.2000	0.00	5.99	7.08	6.68	11.39	13.95	13.10	6.68	7.46	7.09	14.17	15.18	14.51
-.8000	0.00	3.56	4.20	3.95	6.84	8.25	7.77	3.89	4.33	4.14	8.14	8.81	8.43
-1.6000	0.00	2.31	2.71	2.58	4.46	5.33	5.02	2.49	2.80	2.67	5.19	5.67	5.42
							STUMPAGE						
-.1153	0.00	11.38	11.93	11.42	21.63	23.47	22.42	12.69	12.55	12.12	26.92	25.53	24.82
-.4611	0.00	6.77	7.06	6.77	12.99	13.89	13.29	7.38	7.29	7.08	15.46	14.82	14.42
-.9221	0.00	4.39	4.56	4.41	8.47	8.97	8.59	4.74	4.71	4.57	9.86	9.54	9.26

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 0.6 AND 0.8, RESPECTIVELY.
[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974 (BILLION BOARD FEET)	1975
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE 12 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2] — SUPPLY CURVE SHIFTS OUTWARD[3]						SUPPLY CURVE SHIFTS INWARD[3]					
		II	III	IV	V	VI	VII	II	III	IV	V	VI	VII
LUMBER													
-.2000	0.00	4.11	4.88	4.59	7.88	9.55	8.99	4.53	5.06	4.80	9.49	10.23	9.78
-.8000	0.00	2.79	3.29	3.13	5.40	6.47	6.11	3.04	3.40	3.23	6.33	6.89	6.61
-1.6000	0.00	1.97	2.30	2.17	3.80	4.54	4.28	2.12	2.37	2.26	4.39	4.81	4.58
STUMPAGE													
-.1153	0.00	7.82	8.20	7.85	14.98	16.07	15.38	8.60	8.51	8.20	18.02	17.22	16.74
-.4611	0.00	5.30	5.53	5.35	10.25	10.89	10.45	5.77	5.72	5.52	12.03	11.60	11.31
-.9221	0.00	3.74	3.87	3.71	7.22	7.63	7.33	4.02	3.99	3.87	8.34	8.09	7.84

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 1.0 AND 1.2, RESPECTIVELY.
[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974	1975
	(BILLION BOARD FEET)		
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

TABLE 13 PRICE CHANGES FOLLOWING A SHIFT IN THE U.S. SUPPLY CURVE[1]

ELASTICITY ESTIMATE	NO SHIFT	PRICE CHANGES PER THOUSAND BOARD FEET EXPRESSED IN PERCENTAGE TERMS[2] — SUPPLY CURVE SHIFTS OUTWARD[3]						SUPPLY CURVE SHIFTS INWARD[3]					
		II	III	IV	V	VI	VII	II	III	IV	V	VI	VII
LUMBER													
-.2000	0.00	2.79	3.29	3.13	5.40	6.47	6.11	3.04	3.40	3.23	6.33	6.89	6.61
-.8000	0.00	2.13	2.48	2.35	4.10	4.90	4.63	2.29	2.55	2.44	4.76	5.20	4.97
-1.6000	0.00	1.60	1.87	1.77	3.11	3.71	3.50	1.72	1.94	1.84	3.57	3.91	3.73
STUMPAGE													
-.1153	0.00	5.30	5.53	5.35	10.25	10.89	10.45	5.77	5.72	5.52	12.03	11.60	11.31
-.4611	0.00	4.04	4.18	4.02	7.79	8.24	7.91	4.35	4.29	4.16	9.03	8.76	8.50
-.9221	0.00	3.04	3.15	3.03	5.90	6.24	5.99	3.26	3.26	3.15	6.78	6.57	6.38

[1]ASSUMING U.S. AND CANADIAN SUPPLY ELASTICITIES ARE 1.6 AND 1.8, RESPECTIVELY.
[2]TO CONVERT PRICE CHANGES INTO DOLLARS, MULTIPLY CHANGES BY THE FOLLOWING PRICES:

	ASSUMPTION II+V	III+VI	IV+VII
LUMBER	204.80	206.71	206.24
STUMPAGE	107.81	122.86	120.55

[3]THE ASSUMPTIONS ABOUT THE EXTENT AND TIMING OF SUPPLY SHIFTS ARE AS FOLLOWS:

ASSUMPTION	1973	1974	1975
	(BILLION BOARD FEET)		
II	1.70	0.00	0.00
III	.68	.51	.51
IV	1.02	.51	.17
V	3.4	0	0
VI	1.36	1.02	1.02
VII	2.04	1.02	.34

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The impact on softwood lumber and stumpage prices of a hypothetical ban of log exports was computed for alternative assumptions about the market for western softwood lumber. The log export ban was treated as shifting the U.S. supply of western softwood. Various assumptions were made about the direction, extent, and timing of this shift. Other critical assumptions included the values for the U.S. and Canadian supply elasticities and the U.S. demand elasticity. Price changes attributed to log export restrictions were computed for each of the various combinations of assumptions.

KEYWORDS: Supply/demand (forest products), import/export (forest products), trade policy (international).

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1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Developing and evaluating alternative methods and levels of resource management.
3. Achieving optimum sustained resource productivity consistent with maintaining a high quality forest environment.

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